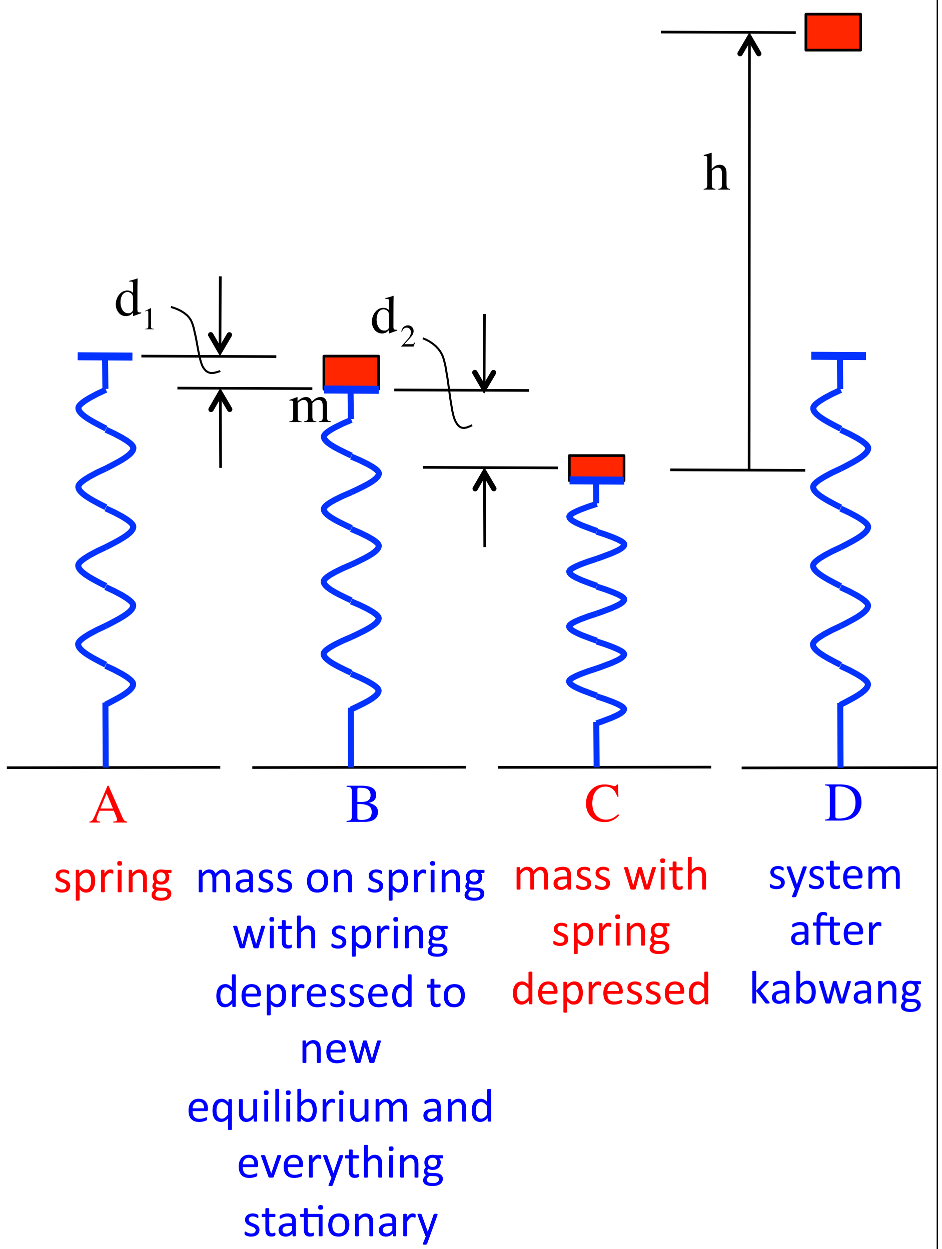
Problem 8.3

This is one of those problems that you can either do simply, almost mindlessly, and get the right answer, or you can way over-think it and find yourself in a muddle. I am going to present the "correct" way of looking at the problem (naturally). At the end, though, I will briefly point out at least one way you might have mess yourself up.



What is actually happening is shown above to the right (this is the start of the over-thinking approach, but I'm letting you see it here, anyway).

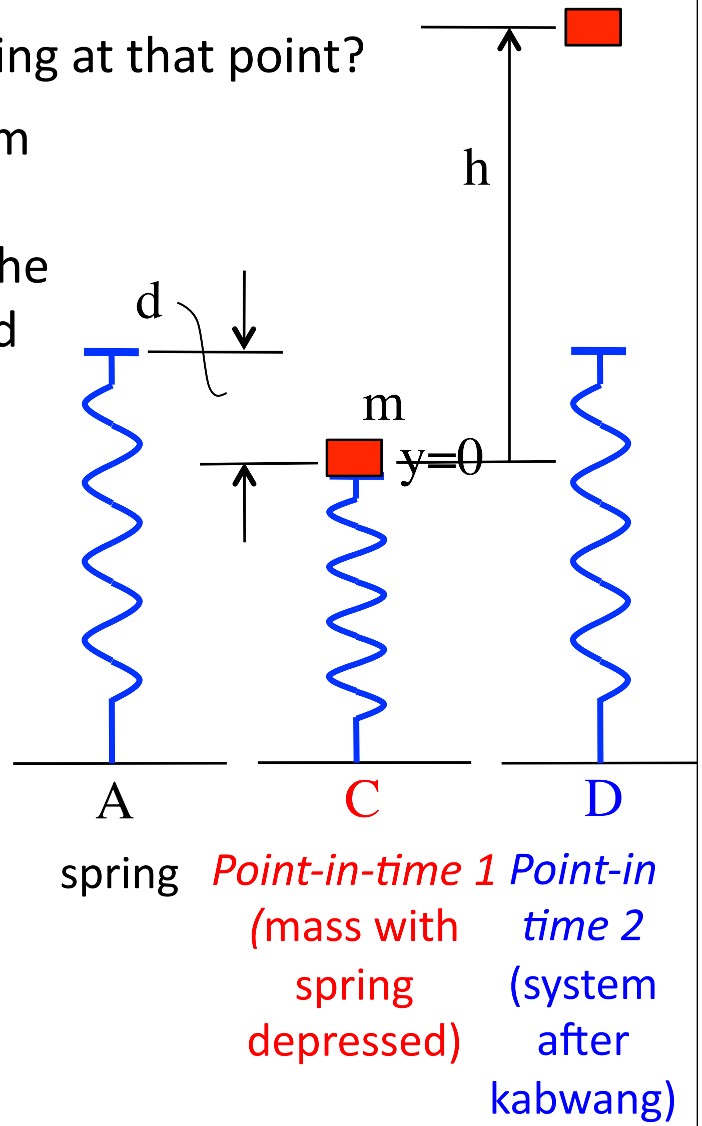
This is the way to look at the system simply:

Letting C be our first *point-in-time*, what is happening at that point?

--The spring is depressed a total distance "d" from its natural equilibrium position (this is different than the equilibrium position with the mass on the spring—we are ignoring the mass, just concerned with the spring). That means there is spring potential energy at *point-in-time 1.*

--With the *zero potential energy level* for gravity defined *in this case* as the lowest the mass will ever get, the mass is at y = 0 at *time 1* (situation C) and there is no gravitational potential energy at that point.

--Because there is nothing in the system that will do *extraneous work*—no friction or other non-conservative forces, or any conservative force that we don't have potential energy functions for, *work extraneous* is zero.



2.)

With all that information, the *modified conservation of energy* yields:

$$\sum KE_1 + \sum U_1 + \sum W_{ext} = \sum KE_2 + \sum U_2$$
$$0 \quad + \left[\frac{1}{2}kd^2\right] + \quad 0 \quad = \quad 0 \quad + \; mgh$$
$$\Rightarrow \qquad h = \frac{kd^2}{2mg}$$
$$\Rightarrow \quad h = \frac{(5000.\ \text{N/m})(.100\ \text{m})^2}{2(.250\ \text{kg})(9.80\ \text{m/s}^2)}$$
$$\Rightarrow \quad h = 10.2\ \text{m}$$

By simply looking at what the individual parts of the system are doing, once you decided to make *C* your *point-in-time 1*, all you have to do is fill in the bailiwicks of the *Modified Conservation of Energy* relationship, then solve.

How might you mess yourself up? Simply, if you had determined the new spring/mass equilibrium position (position B on the first page), then tried to do the problem from there, things could have gotten nasty quickly.